

P.4

Lines in the Plane

Slope of a Line (rate of change)

The **slope** of the nonvertical line through the points (x_1, y_1) and (x_2, y_2) is

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{\Delta y}{\Delta x}$$

If the line is vertical, then $x_1 = x_2$ and the slope is undefined.

Zero slope is a horizontal line and occurs when $y_1 = y_2$.

Example: Find m : $(x, 3)$ and $(5, 9)$ $m = 2$

Point-Slope Form of an Equation of a Line

The **point-slope form of a line** that passes through the point (x_1, y_1) and has slope m is

$$y - y_1 = m (x - x_1).$$

The **y-intercept** of a nonvertical line is the point where the line intersects the y-axis.

See Ex. 2

Slope-Intercept Form of an Equation of a Line

The **slope-intercept form** of an equation of a line with slope m and y-intercept $(0, b)$ is

$$y = mx + b.$$

See Ex. 3

Forms of Equations of Lines

General form: $Ax + By + C = 0$, where A, B are not both 0

Slope-intercept form: $y = mx + b$.

Point-slope form: $y - y_1 = m (x - x_1)$.

Vertical line: $x = a$

Horizontal line: $y = b$

Parallel and Perpendicular Lines

1. Two nonvertical lines are parallel if and only if their slopes are equal.
2. Two nonvertical lines are perpendicular if and only if their slopes m_1 and m_2 are opposite reciprocals. That is, if and only if $m_1 = -\frac{1}{m_2}$.

See Ex. 4 & 5